(12) PATENT APPLICATION (11) Application No. **AU 199524990 A1**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
Slurry sampler

(51) International Patent Classification(s)
G01N 001/20 **F17D 003/00**
B01D 003/04 **F17D 003/10**

(21) Application No: **199524990** (22) Date of Filing: **1995.07.14**

(30) Priority Data

(31) Number	(32) Date	(33) Country
PM6908	**1994.07.18**	**AU**
PN0542	**1995.01.16**	**AU**

(43) Publication Journal Date: **1996.02.01**

(71) Applicant(s)
Quinncorp Pty Ltd

(54) Inventor(s)
Bevan Phillip Quinn

44176 AWT:MH

P/00/001
Section 29

AUSTRALIA
Patents Act 1990

PATENT REQUEST: STANDARD PATENT

We, being the person identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification.

Full application details follow.

[71] **Applicant's name and address:**

QUINNCORP PTY LTD A.C.N. 007 944 569
A South Australian company of 9 Pinda Street, Kilkenny,
State of South Australia

[70] **Nominated Person's name and address:**

QUINNCORP PTY LTD
A South Australian company of 9 Pinda Street, Kilkenny,
State of South Australia

[54] **Invention Title:**

SLURRY SAMPLER

[72] **Name and address of actual inventor:**

BEVAN PHILLIP QUINN
Of 34 Chatsworth Grove, Toorak Gardens, State of South Australia, Australia

[74] Address for service in Australia
COLLISON & CO., 117 King William Street, Adelaide, S.A. 5000
Attorney Code CO

ASSOCIATED PROVISIONAL APPLICATION DETAILS

[60] Application Number PM6908 and Dated 18th July 1994
Application Number PN0542 and Dated 16th January 1995

Dated this 14th day of July 1995

QUINNCORP PTY LTD
By their Patent Attorneys
COLLISON & CO.

ALUN THOMAS

44176 AWT:MH

P/00/008
Section 29(1)
Regulation 3.1(2)

AUSTRALIA
Patents Act 1990

NOTICE OF ENTITLEMENT

We, QUINNCORP PTY LTD A.C.N. 007 944 569 a South Australian company whose registered office is situate at 9 Pinda Street, Kilkenny, State of South Australia, Australia

being the Applicant in respect of the Application filed herewith, state the following:-

The person nominated for the grant of the patent;

has, for the following reasons, gained entitlement from the actual inventor:

The inventor devised the invention in the course of normal employment with the Nominated Person who are entitled to the granted patent under the provisions of Sub-section 15(1)(c) of the Patents Act 1990.

The person nominated for the grant of the patent is;

the applicant of the provisional applications listed on the patent request form.

Dated this 14th day of July 1995

QUINNCORP PTY LTD
By their Patent Attorneys
COLLISON & CO

A A Thomas

ALUN THOMAS

AU9524990

(12) PATENT ABSTRACT (11) Document No. AU-A-24990/95
(19) AUSTRALIAN PATENT OFFICE

(54) Title
SLURRY SAMPLER

(51)[5] International Patent Classification(s)
G01N 001/20 B01D 003/04 F17D 003/00 F17D 003/10

(21) Application No. : 24990/95 (22) Application Date : 14.07.95

(30) Priority Data

(31) Number	(32) Date	(33) Country
PM6908	18.07.94	AU AUSTRALIA
PN0542	16.01.95	AU AUSTRALIA

(43) Publication Date : 01.02.96

(71) Applicant(s)
QUINNCORP PTY LTD

(72) Inventor(s)
BEVAN PHILLIP QUINN

(74) Attorney or Agent
COLLISON & CO , 117 King William Street, ADELAIDE SA 5000

(57)

A sampler (1) for sampling of fluent material such as a slurry flowing in a pipe (10). The slurry is caused to flow over an obstruction (12) such as a cone to provide a flow path with a cross sectional area having a width and a thickness and one or more one open ended sampling tubes (15) extending across the thickness of the flow of fluent material and facing upstream, whereby a proportion of the flow of the fluent material is extracted through the sampling tube and that all portions of the sample have an equal opportunity of being selected. There may be a set of overflow cones (1) in the pipe to direct the flow of slurry evenly onto the cone or agitation baffles (19) upstream of the sampler to provide a homogeneous slurry for sampling.

44176 AWT:MH

P/00/011
Regulation 3.2

AUSTRALIA
Patents Act 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

Name of Applicant:

QUINNCORP PTY LTD

Name of inventor:

BEVAN PHILLIP QUINN

Address for Service:

COLLISON & CO.,117 King William Street, Adelaide, S.A. 5000

Invention Title:

SLURRY SAMPLER

Details of Associated Provisional Applications:

PM6908 and Dated 18th July 1994
PN0542 and Dated 16th January 1995

The following statement is a full description of this invention, including the best method of performing it known to us:

TECHNICAL FIELD

This invention relates to an industrial sampling device and a method of sampling and more particularly to a method of sampling fluid materials such as slurries.

BACKGROUND ART

The very essence of correct sampling of any material in a moving stream is to employ a methodology which assures that all parts of the material being sampled have an equal probability of being collected and becoming part of the final sample for analysis. This is not an easy thing to do when attempting to sample a slurry flowing through a pipe. A slurry in such a situation may tend to settle out particularly if the pipe is substantially horizontal and taking the sample at any one level in the pipe may tend to give an unrepresentative sample. Other problems may occur if the slurry does not completely fill the pipe in which it is flowing. A sampler may miss entirely the slurry if it selects a sample from only a portion of the pipe.

One type of commercially available sampler uses a collection probe which extends through the side of the pipe. Such an arrangement cannot satisfy the sampling methodology enumerated above because all parts of the slurry do not have an equal probability of being collected. This type of sampler tends to extract specimens from the slurry rather than generally representative samples.

Other types of samplers use rotary or reciprocating sample collecting tubes and while these can give a reasonably accurate sample they have moving parts and can be subject to mechanical failure and in many cases are not suitable for the sampling of slurry in pressure pipes.

It is the object of this invention to provide a simple but accurate sample extracting device which is capable of being installed in a pipe whether it be a pressure or gravity feed pipe and which is capable of satisfying the fundamental criterion of assuring that all parts of the slurry have an equal probability of being collected and becoming part of the final sample.

DISCLOSURE OF THE INVENTION

In one form therefore, although this may not necessarily be the only or broadest form, the invention is said to reside in a sampler for sampling of fluent material flowing in a pipe, the sampler comprising an obstruction in the pipe adapted to cause a flow path of the fluent material over or around the obstruction with the flow path providing a cross sectional area having a width and a thickness, at least one open ended sampling tube extending across the thickness of the flow of fluent material and facing upstream, whereby a proportion of the flow of the fluent material is extracted through the sampling tubes and that all portions of the sample have an equal opportunity of being selected.

It will be seen that by this arrangement a representative portion of the entire flow can be selected.

The pipe into which the sampler is placed may be horizontal or vertical or at any other angle.

In one preferred form the obstruction may be a conical obstruction in a cylindrical pipe with the point of the conical obstruction extending into the oncoming flow of slurry. The conical obstruction provides an annular flow path by causing the slurry to flow over and around the conical obstruction with portions of the annular flow path having the sample collecting tubes adapted to extract the sample.

The sample may be collected from the sides of the conical obstruction or from an annular flow path region extending from the terminal end of the conical obstruction. Alternatively there may be a further tapering conical portion extending from the terminal end of the conical obstruction which returns the flow of slurry back to a pipeline and the sample may be collected from the sides of the tapering conical portion.

There may be two types of sampler depending upon the type of flow of slurry which is expected.

A first type of sampler may be for flow in pressurised pipes. In such a situation it is preferable that there is minimum disruption to the flow of slurry.

In one preferred form the sampler may be constructed so that the cross sectional area of the flow path remains substantially constant through the sampler. The sampler in this embodiment may be a closed system.

In an alternative preferred form the sampler may be constructed so that the velocity of the flow of slurry remains substantially unaltered of constant through the sampler.

A second type is for low flow or gravity feed pipes or where the flow may vary considerably. In such a situation the sampler is used in a vertical section of pipe and means may be provided to ensure even flow over the obstruction. The sampler in this embodiment may be open at the top.

The means provided to ensure an even flow of the material to be sampled over the obstruction may in one embodiment in a gravity flow system be a set of inverted truncated cones which are arranged concentrically and directly over the obstruction. Such a set of truncated cones may be termed a set of overflow cones.

The construction and principle of operation of such overflow cones may be as follows. The smallest cone director may have a smaller aperture of perhaps 25% to 50% of the diameter of a feed pipe. The other cone directors may have smaller apertures in the range up to 125% to 150% of the diameter of the feed pipe. The larger aperture of each frusto conical cone director may be of about the same diameter as the feed pipe or be of a greater diameter than the feed pipe.

If there is a flow rate less than the full volume of the feed pipe then the smallest cone takes the flow and directs it through its smaller aperture onto the apex of the obstruction. As flow builds up the amount of material in the first cone builds up and over flows into the second and if necessary third cone director. In this way whatever the flow the feed is directed evenly over the obstruction.

In another embodiment of the invention there may be provided a means to induce turbulence or swirling in the flow of fluent material associated with the obstruction or placed before the obstruction to ensure good mixing throughout the width and thickness of the flow and a better opportunity for any part of the

flow to be sampled.

Preferably the sampling points may be equally spaced along the width of the flow. In the case of an annular flow path the sampling points may be positioned equally around the circumference of the annular path.

In an alternative form the invention may be said to reside in a slurry sampler comprising a fitting adapted to be fitted into a flow line for the slurry such that the slurry flows through the fitting, the fitting having a conical obstruction defining an annular flow path for the slurry around the obstruction and a plurality of sample off-take pipes opening into the annular flow path and each adapted to take a portion of the slurry flow.

Preferably the sample off-take pipes extend across the full radial thickness of the annular flow path and a proportion of the circumference of the flow path.

Such a sampler may take a percentage only of the total flow, for instance, five or ten percent of the total flow of slurry and after initial selection further sampling techniques may be used to take only a proportion of the sample and excess slurry may be returned to the main flow line. Such additional sampling techniques may comprise smaller versions of the sampler of the present invention.

In a further form the invention may be said to reside in a method of selecting a representative proportion of material from a flow of fluid material in a pipe comprising the steps of forming the flow of fluid material into a flow area having a width and a thickness and selecting a proportion of the flow area being of the entire thickness of the flow and a proportion of the width.

Preferably the step of forming the flow of fluid material into a flow area having a width and a thickness is achieved by provision of an obstruction in the pipe.

Preferably the surface area of the flow area around the obstruction is greater than or is about the same as the unrestricted flow area in the pipe to prevent back pressure building up at the point of sample selection.

There may be provided means to produce turbulence or swirling in the flow of fluent material in the pipe upstream of the obstruction to give good mixing.

Preferably therefore, there is non-streamline flow over the obstruction.

The flow area may be annular with the obstruction occurring over a conical obstruction in an enlarged portion of the pipe.

The fluent material may be a powder, a liquid or a slurry.

In an alternative form the invention may be said to reside in an overflow cone arrangement adapted to reside in a flow pipe, the overflow cone arrangement adapted to take a flow of irregular or varying cross section within the flow pipe and to provide a more even flow in the flow pipe, the overflow cone arrangement comprising one or a plurality of inverted concentric frusto-conical directors within the flow pipe, the directors being in a range of sizes from a smallest to a largest director, each director having an uppermost larger inlet and a lowermost smaller outlet with the outlet of the smallest director being of less cross sectional area than the flow pipe and the outlet of the largest director being substantially the same as or of a greater diameter than the feed pipe.

In one preferred embodiment there may be three cone directors.

This then generally describes the invention but to assist with understanding reference will now be made to the accompanying drawings which show a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings;

FIG 1 shows a cross-sectional view of one embodiment of a sampler according to this invention,

FIG 2 shows a cross-sectional view on the lines 2 - 2' in FIG 1,

FIG 3 shows a cross section of an alternative embodiment of sampler according to this invention,

FIG 4 shows a cross-sectional view of an alternative embodiment of a sampler according to this invention,

FIG 5 shows a cross-sectional view of a further alternative embodiment of a sampler according to this invention,

FIG 6 shows a cross-sectional view of a further alternative embodiment of a sampler according to this invention,

FIG 7 shows a cross-sectional view of a further alternative embodiment of a sampler according to this invention,

FIG 8 shows a cross-sectional view of a further alternative embodiment of a sampler according to this invention, and

FIG 9 shows a cross-sectional view of a further alternative embodiment of a sampler according to this invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Now looking more closely at the embodiment shown in Figures 1 and 2 it will be seen that the sampler generally shown as 1 is installed in a pipe 10 and comprises a portion of the pipe 2 which is expanded to a greater diameter and in which is placed a conical obstruction 12. This provides an annular flow path 14 defined between the enlarged portion 2 of the pipe 10 and the conical obstruction 12. A number of sample off-take orifices 15 are positioned around the circumference of the conical obstruction 12 and each sample off-take orifice 15 takes the complete radial thickness of the annular flow and a proportion of the circumference of the flow. The shape of each sample off-take orifices 15 is preferably that defined by radial walls 18 and the inner and outer circumferential walls of the conical obstruction 12 and the pipe 2 respectively. Each of the sample off-take orifices 15 collects sample into sample off-take pipes 16 which are collected together into a sample output tube 17.

The region 5 below the conical obstruction allows the flow to be re-concentrated into a single flow in the outlet pipe 11 without providing any back pressure to the region of flow around the obstruction 12.

There may be provided an arrangement in the pipe 10 to induce homogeneity to the fluent material flowing in the pipe. In this embodiment such a device is before the conical obstruction 12 to make the flow of fluent material turbulent or swirling. In this embodiment this is provided by vanes 19 built onto the inside of the walls of the pipe 10. Other devices such as rods across the flow pipe to induce turbulence may also be used. Alternatively the obstruction such as the conical obstruction of this embodiment may include vanes, protrusions, roughening or other means for inducing homogeneity such as by swirling or turbulence.

By this embodiment there is provided an equal probability of any part of the flow being selected and hence most accurate sampling being possible.

FIG 3 shows an arrangement which is particularly adapted for gravity flow lines. Feed pipe 20 supplies slurry to be sampled and directs it onto conical obstruction 21 in the sampler assembly 22. Because the flow may be less than the entire cross section of the feed pipe 20 then overflow cone directors 23 are used to direct the flow evenly onto the obstruction 21 and hence a representative sample may be taken by the sampling cutter 24 to be directed into the sample tube 25.

If the flow is greater than can be contained within the smallest director 29 then it overflows over the side of the smallest director 29 and is directed to the apex of the obstruction 21 by the director 26. Even greater flow will be similarly captured by the outer director 27. Even if the flow overflows the largest director 27 it may be caught by the outer wall 30 of the sampler and included in the sampling. By this means, regardless of the volume of flow in the feed pipe a representative sample may be taken. The bulk of the flow after sampling exits through the tube 28.

The sampler in this embodiment is adapted to be used with gravity or low or variable flows of slurry and has an open upper end of the sampler.

FIGS 4 to 9 show various arrangements of obstructions and positioning of sample collection orifices and tubes. These embodiment are generally intended for flow in pressure lines and although they are illustrated as being vertical they may be used at any convenient angle.

In FIG 4 the sample collection tube 40 is positioned so that the collection orifice 41 is at the widest point of a conical obstruction 42 which also has a tapered conical director 43 back to the pipe 44 after the collection orifice 41. It will be noted that in this embodiment the radial width of the annular region between the conical obstruction 42 and the outer wall 46 reduces towards the widest part of the conical obstruction so that the cross sectional area of the annular flow path remains substantially constant.

In FIG 5 The sampler comprises a conical obstruction 52 in an enlarged portion of a pipe 54. The obstruction 52 includes spiral vanes 55 which are intended to provide swirling and mixing of the flowing slurry. The sample collection tube 50 is positioned so that the collection orifice 51 is after the widest point of a conical obstruction 52 and adjacent a tapered conical director 53 back to the pipe 54 after the collection orifice 51.

In FIG 6 The sampler comprises a conical obstruction 62 in an enlarged portion of a pipe 64. The obstruction 62 includes a number of protrusions 65 and there are a number of protrusions 66 on the inside of the enlarged portion of the pipe and a number of protrusions 67 in the pipe before the enlarged portion. These protrusion assist in the mixing of the slurry flowing in the sampler to ensure a homogeneous as possible sample. The sample collection tube 60 is positioned so that the collection orifice 61 is before the widest point of a conical obstruction 62 which also has a tapered conical director 63 back to the pipe 64 after the collection orifice 61.

In FIG 7 the obstruction 70 comprises an upper conical portion 71, an intermediate cylindrical portion 72 and a tapering lower conical portion 73 . Flow of slurry is directed around the obstruction from inlet pipe 74 to outlet pipe 75. The sample collection tube 76 is positioned so that the collection orifice 77 is along the cylindrical portion of the obstruction 70. It will be noted that in this embodiment the radial width of the annular region between the conical obstruction 71 and the outer wall 78 reduces towards the widest part of the conical obstruction and along the cylindrical portion of the obstruction so that the cross sectional area of the annular flow path remains substantially constant.

In FIG 8 the sample collection tube 80 is positioned so that the collection orifice 81 is at the widest point of a semicircular obstruction 82 which also has

a tapered director 83 back to the pipe 84 after the collection orifice 81.

In FIG 9 the sample collection tube 90 is positioned so that the collection orifice 91 is after the widest point of a semicircular obstruction 92 and adjacent a tapered director 93 back to the pipe 94 after the collection orifice 91.

Each of these embodiments of positioning of collection orifices may be useful depending upon the expected flow rates, composition of the slurry and allowable pressure drop.

Throughout this specification and the claims that follow unless the context requires otherwise, the words 'comprise' and 'include' and variations such as 'comprising' and 'including' will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A sampler for sampling of fluent material flowing in a pipe, the sampler comprising an obstruction in the pipe adapted to cause a flow path of the fluent material over or around the obstruction with the flow path providing a cross sectional area having a width and a thickness, at least one open ended sampling tube extending across the thickness of the flow of fluent material and facing upstream, whereby a proportion of the flow of the fluent material is extracted through the sampling tube and that all portions of the sample have an equal opportunity of being selected.

2. A sampler as in Claim 1 wherein the obstruction comprises a conical obstruction with the point of the conical obstruction extending into the oncoming flow of fluent material whereby the conical obstruction provides an annular flow path by causing the slurry to flow over and around the conical obstruction.

3. A sampler as in Claim 2 wherein the sample is collected from the sides of the conical obstruction by means of the at least one sample collection tube.

4. A sampler as in Claim 1 wherein the obstruction comprises a conical obstruction and an annular duct extending from the terminal end of the conical obstruction with the point of the conical obstruction extending into the oncoming flow of fluent material whereby the conical obstruction provides an annular flow path by causing the slurry to flow over and around the conical obstruction the sample is collected from the annular duct by means of the at least one sample collection tube.

5. A sampler as in Claim 1 wherein the obstruction comprises a conical obstruction and a further tapering conical portion extending from the terminal end of the conical obstruction with the point of the conical obstruction extending into the oncoming flow of fluent material whereby the conical obstruction provides an annular flow path by causing the slurry to flow over and around the conical obstruction the sample is collected from the sides of the tapering conical portion by means of the at least one sample collection tube.

6. A sampler as in any one preceding claim further including an overflow cone arrangement adapted to take a flow of irregular or varying cross section within the pipe and to provide a more even flow onto the obstruction, the overflow cone arrangement comprising one or a plurality of inverted concentric frusto-conical directors, the directors being in a range of sizes from a smaller to a larger director, each director having an uppermost larger inlet and a lowermost smaller outlet with the outlet of the smallest director being of less cross sectional area than the pipe and the outlet of the largest director being substantially the same as or of a greater diameter than the pipe.

7. A sampler as in Claim 6 wherein there are three concentric overflow cones.

8. A sampler as in any one preceding claim further including means to produce turbulence or swirling in the flow of fluent material in the pipe upstream of the obstruction to give good mixing.

9. A sampler as in Claim 8 wherein the means to produce turbulence or swirling in the flow of fluent material in the pipe comprises a plurality of spiral vanes.

10. A sampler as in any one preceding claim further including means to produce turbulence or mixing in the flow of fluent material in the sampler on or associated with the obstruction.

11. A sampler as in Claim 10 wherein the means to produce turbulence or mixing in the flow of fluent material on or associated with the obstruction comprises a plurality of spiral vanes.

12. A sampler as in any one preceding claim wherein the flow path is of substantially constant cross sectional area past the obstruction.

13. A sampler as in any one preceding claim wherein the sampler is so constructed that the velocity of the flow of fluent material remains substantially constant past the obstruction.

14. A sampler as any one preceding claim wherein the sampler is adapted for use in a pressurised flow pipe.

15. A sampler as in Claim 1 wherein the sampler is adapted for use in a gravity flow pipe and in which the sampler is open at its upper end.

16. A slurry sampler comprising a fitting adapted to be fitted into a flow line for the slurry such that the slurry flows through the fitting, the fitting having a conical obstruction defining an annular flow path for the slurry around the obstruction and a plurality of sample off-take pipes opening into the annular flow path and each adapted to take a portion of the slurry flow.

17. A method of selecting a representative proportion of material from a flow of fluid material in a pipe comprising the steps of forming the flow of fluid material into a flow area having a width and a thickness and selecting a proportion of the flow area being of the entire thickness of the flow and a proportion of the width.

18. A method as in Claim 14 wherein the flow area is formed by means of flowing the flow of fluid material over a conical obstruction

19. An overflow cone arrangement adapted to reside in a flow pipe, the overflow cone arrangement adapted to take a flow of irregular or varying cross section within the flow pipe and to provide a more even flow in the flow pipe, the overflow cone arrangement comprising one or a, a plurality of inverted concentric frusto-conical directors within the flow pipe, the directors being in a range of sizes from a smaller to a larger director, each director having an uppermost larger inlet and a lowermost smaller outlet with the outlet of the smallest director being of less cross sectional area than the flow pipe and the outlet of the largest director being substantially the same as or of a greater diameter than the feed pipe.

20. An overflow cone arrangement as in Claim 19 wherein there are three concentric overflow cones.

Dated this 14th day of July 1995

QUINNCORP PTY LTD
By their Patent Attorneys
COLLISON & CO

ABSTRACT

A sampler (1) for sampling of fluent material such as a slurry flowing in a pipe (10). The slurry is caused to flow over an obstruction (12) such as a cone to provide a flow path with a cross sectional area having a width and a thickness and one or more one open ended sampling tubes (15) extending across the thickness of the flow of fluent material and facing upstream, whereby a proportion of the flow of the fluent material is extracted through the sampling tube and that all portions of the sample have an equal opportunity of being selected. There may be a set of overflow cones (1) in the pipe to direct the flow of slurry evenly onto the cone or agitation baffles (19) upstream of the sampler to provide a homogeneous slurry for sampling.

24990/95

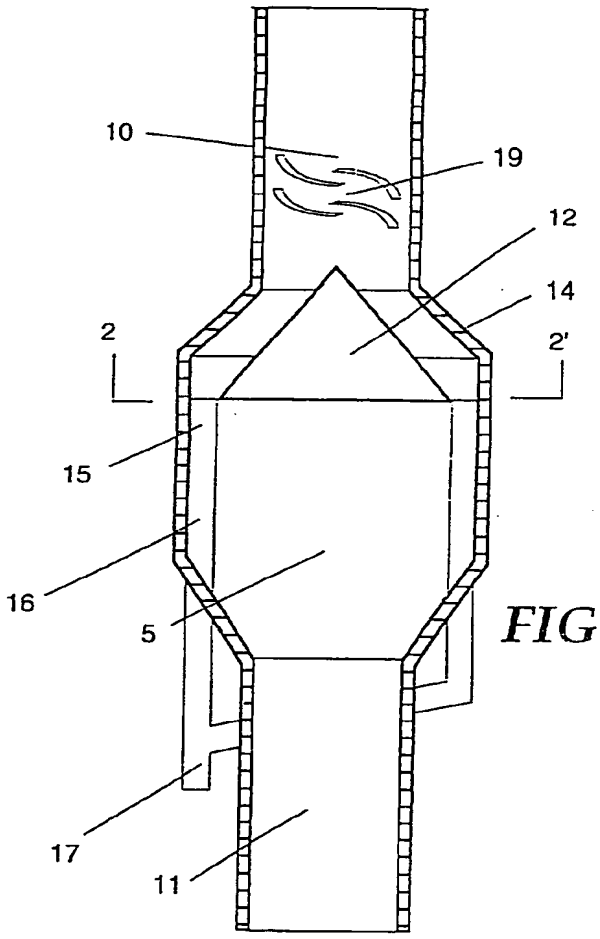

FIG 1

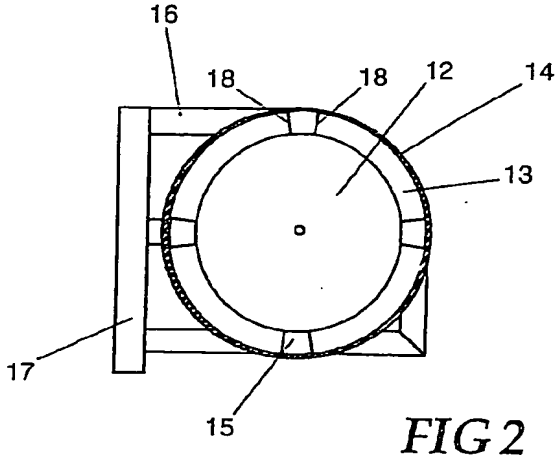

FIG 2

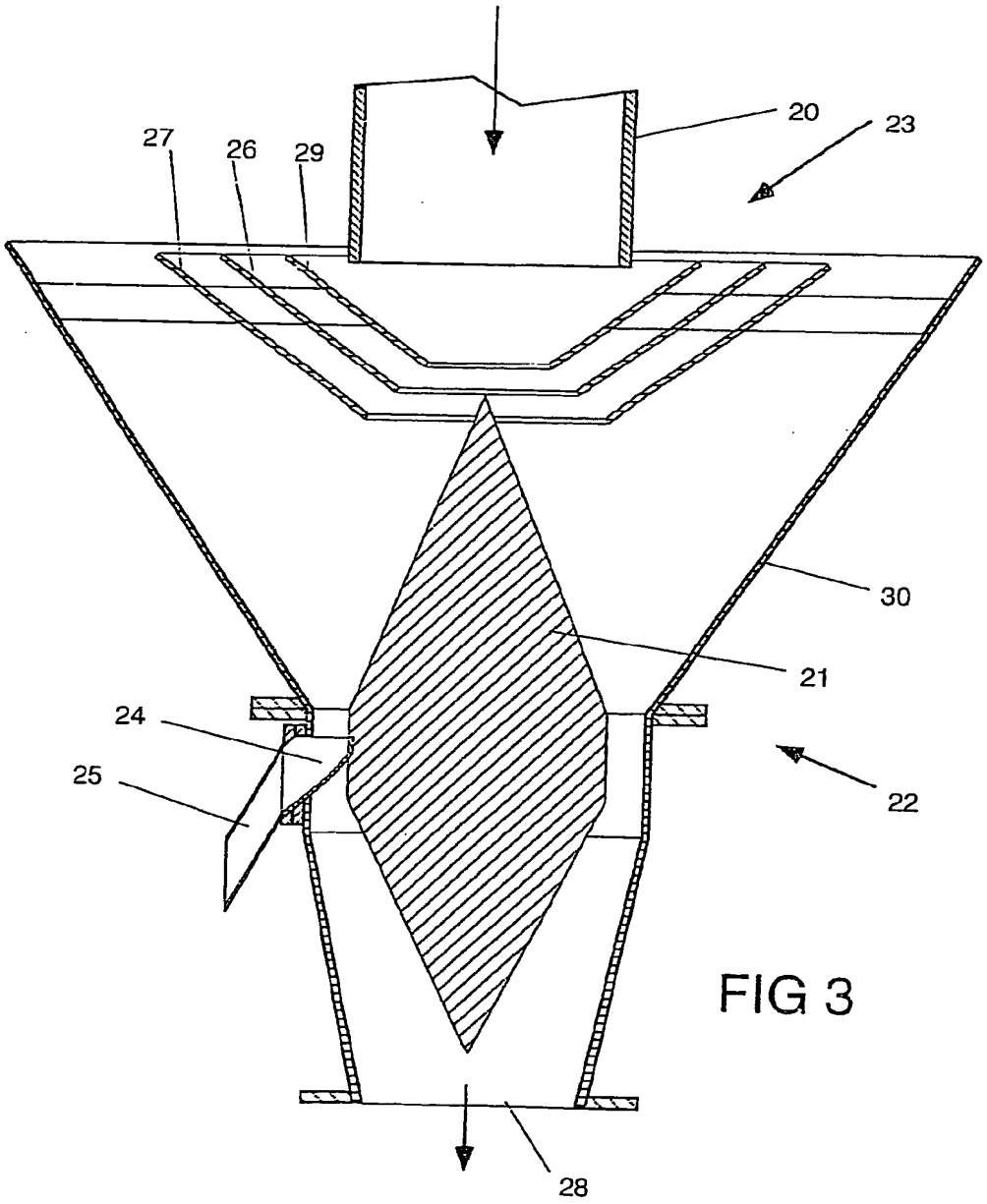

FIG 3

24990/95

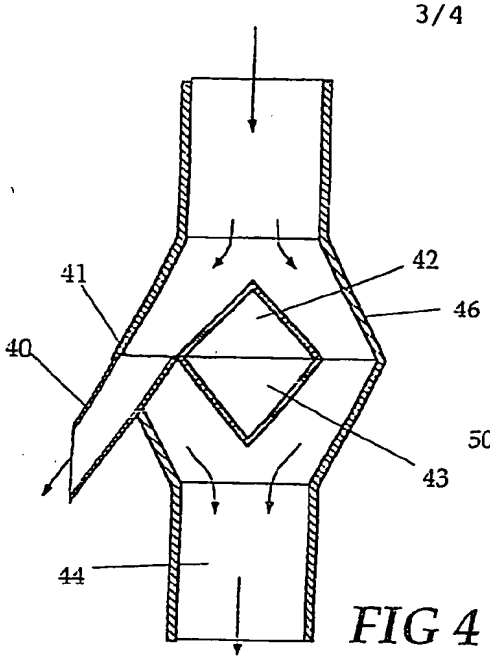

FIG 4

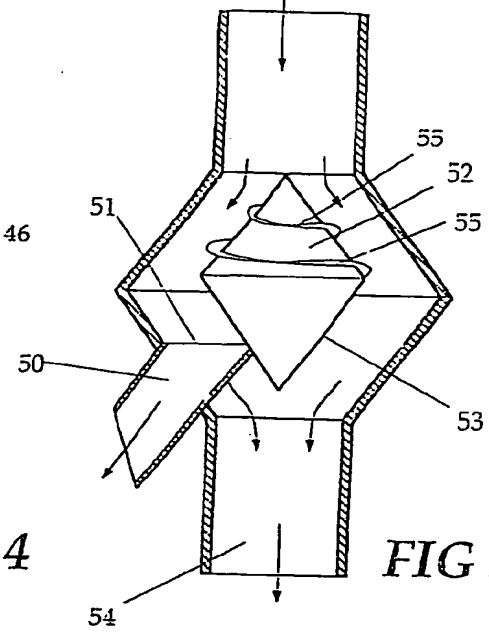

FIG 5

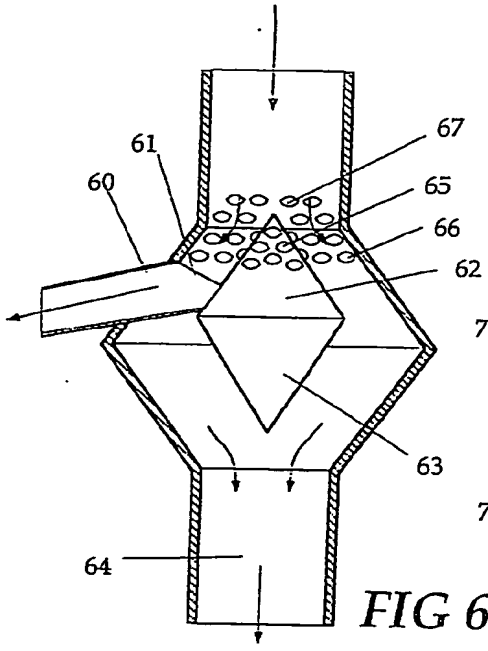

FIG 6

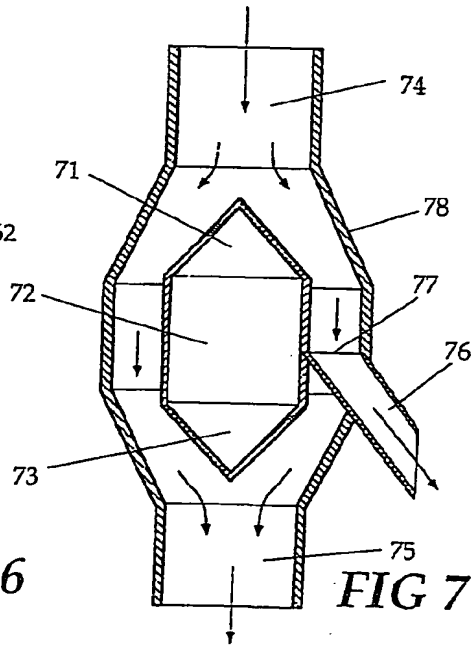

FIG 7

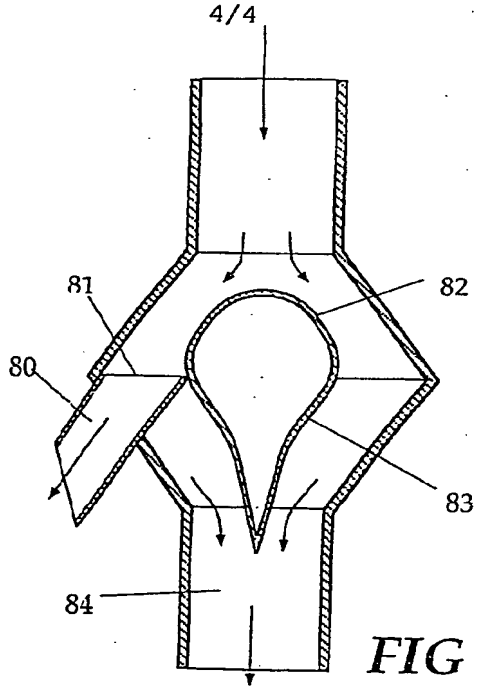

FIG 8

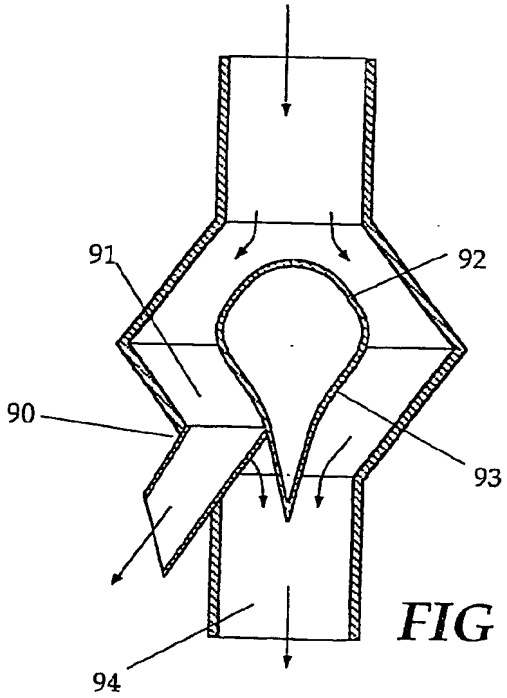

FIG 9